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ABSTRACT

The first of three issues presents seven articles dealing with recent developments in educational research. The first article, "Black College Faculty: A Dwindling Resource," discusses the relative lack of black college teachers and the declining interst of new black Ph.D.s in careers in academia. The second article, "Introducing the ETS Policy Information Center," presents the Center's purpose, namely, to focus the capacity and resources of the organization on pressing educational issues and to enhance the public policy debate. The third article, "Who's Going to Graduate and Professional Schools?" details the decline in graduate school attendance and the trend toward attending professional schools. The fourth article, "What's Wrong with This Picture?" analyzes a graph distributed by a federal agency that distorts the educational productivity of the nation. The fifth article, "State Profiles of Educational Standards Updated," gives highlights from the new report "State Educational Standards in the 50 States: An Update," by E. Goertz. The sixth article, "Report Highlights College Minority Retention Programs," is a review of a study on minority retention in higher education by B. C. Clewell and M. S. Ficklen. The seventh article, "New Studies Montior Talent Flow into Technical Fields," considers two studies of trends among students planning to major in mathematics, science, or engineering. The second issue provides three articles dealing with college-bound high school students. The first article is titled "Edging Forward: What the SAT (Scholastic Aptitude Test) Shows about College-Bound Seniors in the 1980s." The second article, "Starting on the Right Track," reviews an Education Testing Service (ETS) study by R. Ekstrom and V. Lee suggesting that guidance counseling is not equally available to all secondary students. The third article, "High-Achieving Hispanic Students," introduces an ETS study by B. C. Clewell and M. F. Joy that describes the first cohort of applicants for the National Hispanic Scholar Awards for students planning to attend college. The third issue provides three articles that consider some concerns in science education. The first article, "A Precious Few: Interest of the College-Bound in the Quantitative Sciences," discusses the decline of the nation's scientific and engineering workforce. The second article, "A Straggler's View: The U.S. in the World of Science Education," highlights some findings of

the International Assessment of Educational Progress. The third article is titled "Staying Power: Students Who Persist" (Thomas L. Hilton et al.). Figures and tables are included in all the issues. (SLD)

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ETS POLICY NOTES

News from the ETS Policy Information Center

Volume I, Number 1 | Educational Testing Service, Princeton, New Jersey | July 1988

Black College Faculty: A Dwindling Resource

Duke University faculty recently recommended that every department be required to hire at least one new Black faculty member by 1993. Similar plans are being enacted at other campuses as well. The need for such policies is supported by data from a new study that paints a bleak picture of Black participation in academe.

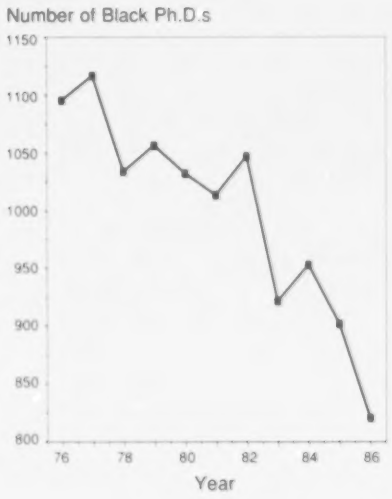
Increasing Minority Faculty: An Elusive Goal, by Shirley Vining Brown, shows that the number of Black Ph.D.s is minuscule and decreasing. In 1976 there were 1095 new Black Ph.D.s; by 1986 that number dropped to 820 (see Figure 1). And during the same period, new Black doctorates dropped from 4.2 percent to 3.6 percent of all new Ph.D.s.

Information on academic specializations reflects another dimension of the problem. Black doctorates are concentrated in education, the social sciences, and in a category called Professions/Other. In fact, in 1984, only 17 percent of the doctorates awarded to Blacks were in scientific and technological fields (179 doctorates) and only 12 percent were in the humanities (131 doctorates), while nearly half were in education.

There has also been a switch in the gender composition of the new Black Ph.D. pool. Women accounted for about 35 percent of the Black Ph.D.s in 1975, but by 1986 they accounted for more than 60 percent.

In the past, Black Ph.D.s opted for teaching careers in colleges and universities. Today new Black doctorates are choosing to go into business and industry. More than two-thirds of all Black Ph.D. recipients went into academe in 1975, but less than half planned academic careers in 1986. Moreover, when one considers that this shortfall was based on almost 18 percent fewer Black doctorates than in 1975, it is clear that increasing Black faculty on college campuses will require significant efforts and new policy incentives on the part of postsecondary institutions. This is especially true in light of the past experiences of Black academics.

Figure 1



(continued on page 8)

Introducing the ETS Policy Information Center

ETS conducts one of the largest programs of educational research in the world, focusing on education policy and practice, measurement methodology, and human development and learning. Its research staff each year makes hundreds of presentations and produces scores of papers and publications related to educational assessment and policy issues. In addition, through its program operations and related services, the organization processes educational and demographic information on several million individuals.

The primary purpose of the ETS Policy Information Center is to focus the organization's unique

(continued on page 2)

ETS Policy Information Center *(continued from page 1)*

capacity and resources on pressing educational issues and to enhance the public policy debate. To that end, the Center will:

- Disseminate existing ETS research on policy-related topics in familiar language to policymakers and the public in order to move important ideas into practitioners' classrooms and decision makers' arenas.
- Bring ETS's unique information data bases to bear on public policy issues related to such fundamental concerns as academic performance, educational equity, and test use.

This is the first issue of *ETS Policy Notes*. Subsequent issues will be published periodically. Readers' comments will be welcome.

Who's Going to Graduate and Professional Schools?

In recent years, educators have become increasingly concerned about the future of graduate education in America. Too few students are opting for advanced study, critics allege, and minorities are not represented in adequate numbers.

John Brademas, president of New York University, has written that graduate institutions are endangered. He warns, "Only effective action by the federal government will avert a crisis."

ETS researcher Thomas L. Hilton says, "If it were not for foreign students, a lot of graduate departments would be in trouble. In engineering, one-half of advanced degrees now go to foreign students."

In order to better understand the dynamics underlying the decline in graduate school attendance, Hilton and fellow ETS researcher William B. Schrader conducted a study of students' academic careers, *Pathways to Graduate School: An Empirical Study Based on National Longitudinal Data* (RR-87-41). They analyzed data collected at several stages in 23,451 students' careers to identify routes leading to graduate and professional schools.

They found that, seven years out of high school, three percent of high school seniors had enrolled full time in graduate school, and the same percentage had enrolled in professional school. White students and students with high socioeconomic status were most likely to be enrolled in graduate or professional school.

Although relatively small numbers of Black students attend graduate and professional schools, the proportion of high-ability Black students in the institutions proved consistently higher than that of high-ability White students. While the authors advise that this result should be viewed with caution because of the small number of high-ability Black students sampled, they say their results suggest that Black students who earn relatively high test scores are progressing to the highest levels of education.

For Hispanic students, the picture is less encouraging. Although a somewhat higher proportion of Hispanic students than Black students start out in academic programs, the proportion going to four-year colleges is far lower. Instead, Hispanic students disproportionately enroll in two-year colleges, and very few go on to four-year institutions.

As might be expected, students who pursued an academic track in high school and enrolled in four-year colleges as freshmen were most likely to enter graduate or professional programs. Nowadays, however, many of the best students are being lured away from graduate study by the professional schools. Hilton and Schrader report that, as high school students, "The professional school enrollees were more able, especially in mathematics; had higher educational aspirations; had better educated parents; and reported they were less influenced by their high school teachers in their career planning."

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What's Wrong With This Picture? ⟶

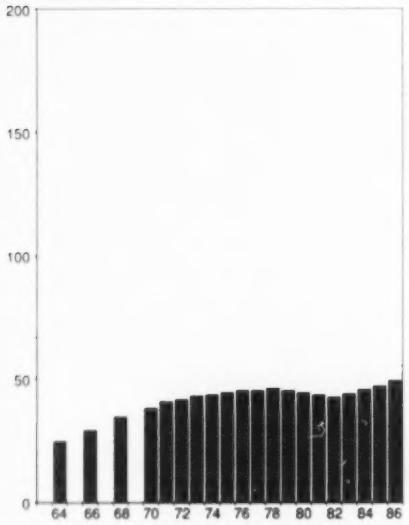
In an attempt to undermine the notion that money matters, a senior federal education official has distributed a graph purporting to demonstrate that increased educational spending during the last two decades resulted in lower achievement, as measured by SAT scores.

The graph (Figure 2) is as inaccurate as it is dramatic. The steep escalation in spending was achieved by tracking expenditures in current dollars rather than in constant dollars adjusted for inflation. A graph that accurately depicts spending in terms of constant dollars (Figure 3) reveals that expenditures have barely risen during the last 20 years.

Similarly, the decline in SAT scores is made to seem precipitous by foreshortening the 400 — 1600 score range to a narrower 800 — 1000 scale. An accurate

Figure 3

Elementary/Secondary Education Spending In Constant Dollars (Billions)



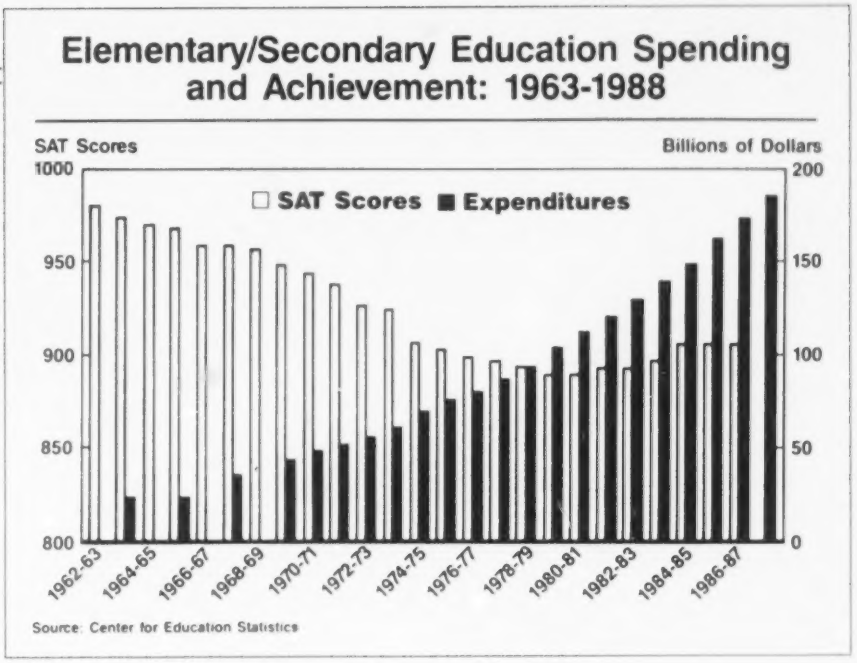


Figure 2

graph (Figure 4) reveals the drop in scores to be considerably less severe.

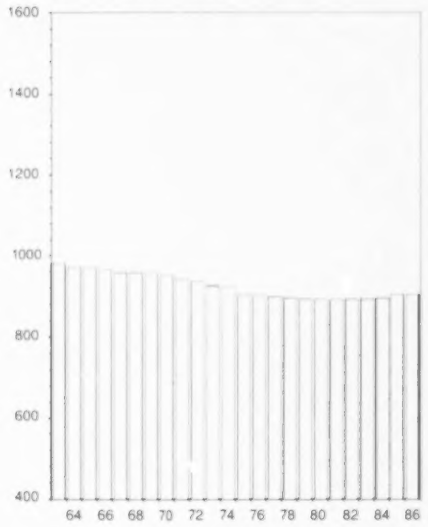
Moreover, for a number of reasons, the SAT is an inappropriate measure of overall educational productivity. First, students who take the SAT do not represent a random sample of the school-age population. Second, the SAT pool has become more diverse. Third, educational spending is not directed toward raising SAT scores.

In contrast to Figure 2's gloomy assessment, the record of the last two decades reveals remarkable productivity in education, given the relatively constant dollars available. Schools have increased services to "high cost" groups — the disadvantaged, handicapped students, and preschoolers. Test scores for children in the lower grades — particularly minority children — have begun to rise substantially. More students are taking college-preparatory courses, finishing high school, and going on to higher education.

It may well be that present rates of achievement will not make us competitive in the year 2020. But exhortation to excellence alone is not sufficient to improve performance. If we are really serious about improving education, we will need the will and the enthusiasm of the education community — teachers, parents, students, business leaders, legislators — and the money to get the job done. Money does matter! ■

Figure 4

SAT Scores, 1963 to 1986



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State Profiles of Educational Standards Updated

The 1983 publication of *A Nation At Risk* and other reports criticizing American elementary and secondary education intensified state education reform activities. Forty-four states now test elementary and secondary school students, 45 impose high school coursework requirements, and 38 require aspiring teachers to pass a test prior to certification.

These highlights are drawn from a new report, *State Educational Standards in the 50 States: An Update* (RR-88-22), prepared by ETS researcher Margaret E. Goertz.

The 146-page publication includes an overview of standards in effect in 1986-87 and changes since 1984-85. The report provides a comprehensive and convenient summary, as well as state-by-state profiles, of educational standards affecting students (testing, high school graduation requirements, attendance, and other policies), teachers (teacher preparation, certification, relicensing, and staff development), and schools and school districts (curriculum requirements and length of the school day and year).

Student Testing

All 44 states that require student testing focus on basic skills, particularly math, reading, and language. Six states include writing, reasoning skills, and citizenship, and six others include science and social studies. Three states have or are developing instruments to assess higher level skills or achievement at the secondary school level.

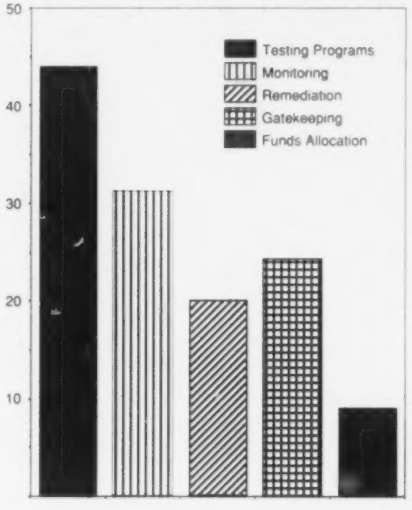
States use their testing programs for a variety of purposes:

- to monitor student, school, and/or school district performance,
- to identify students in need of remediation,
- as a requirement for grade promotion and/or high school graduation (gatekeeping), and/or
- as a basis for allocating state aid for compensatory education.

Figure 5 shows the numbers of states with testing programs and the purposes of the programs.

Figure 5

State Testing Programs and Purposes, 1986-87



Report Highlights College Minority Retention Programs

The attrition of minority students in higher education is a major obstacle to equal educational attainment. The impact of gains in enrolling minority students has been eroded by an attrition rate that is substantially higher for minority than for nonminority students. Attrition is particularly high for minority students attending predominantly White institutions.

In order to reverse this trend, researchers must determine why students drop out and what can be done to prevent their withdrawal.

ETS researchers Beatriz C. Clewell and Myra S. Ficklen addressed that question in their study, *Improving Minority Retention in Higher Education: A Search for Effective Institutional Practices* (RR-86-17). They examined retention programs at four predominantly White institutions with good minority retention rates to identify variables that enhance retention. The schools varied in terms of institutional environment, including selectivity, size, and proportion of minorities on campus; rationales for developing retention programs; grade levels of students served by special programs; and

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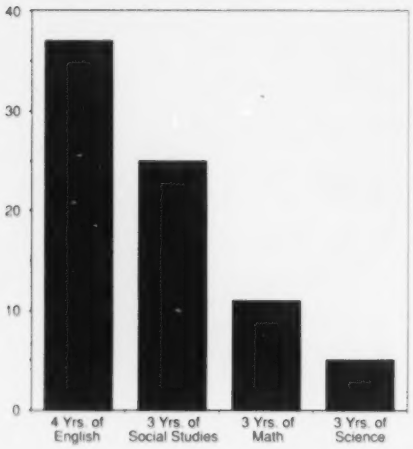
Graduation Requirements

In the wake of this reform activity, 42 states increased their course requirements in the "new basics"—English, math, science, social studies, and computer science. But the requirements of many states still fall short of the recommendations made by the National Commission on Excellence in Education (NCEE). Figure 6 shows the numbers of states that meet or exceed the NCEE recommendations of four years of English and three years each of social studies, math, and science.

Figure 6

Number of States Meeting or Exceeding National Commission on Excellence in Education Recommendations for High School Graduation Requirements

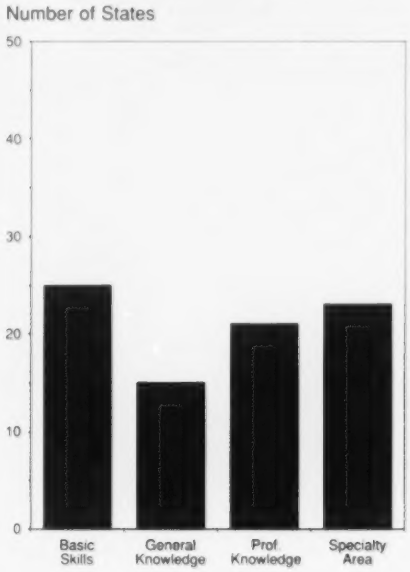


Teacher Testing

In 1986-87, 38 states required aspiring teachers to pass a state-prescribed, standardized test before entering a teacher education program and/or before being certified to teach. The states vary considerably in the areas tested (basic skills, general knowledge, professional knowledge, and/or knowledge of the teaching specialty). Figure 7 shows the number of states that test prospective teachers in each area.

Figure 7

Areas Tested for Completion of Teacher Education and Certification, 1986-87



scope and type of services. The study found that retention efforts for minority students can be developed and carried out successfully in many different ways, at different types of institutions.

While settings for success may be diverse, the researchers identified eight characteristics common to all successful retention programs. These characteristics were:

- A stated policy on minority enrollments,
- A high level of institutional commitment,
- A substantially institutionalized program,
- Comprehensive services,
- Dedicated staff,
- Systematic data collection, monitoring, and follow-up,
- Strong faculty support, and
- Non-stigmatization of participants.

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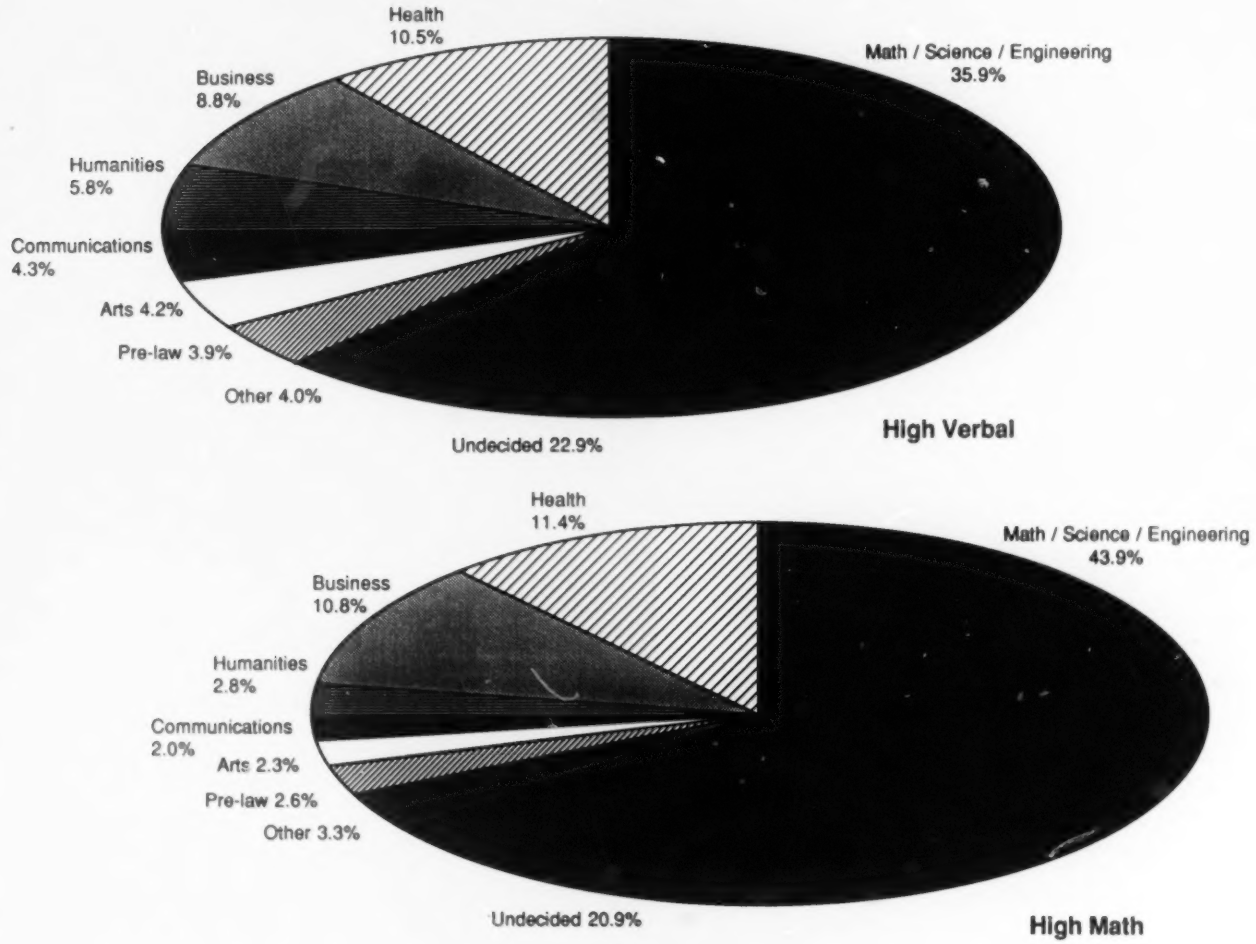
Figure 8

Major Field Selections of 1986 High School Seniors Scoring Above the 90th Percentile on SAT Verbal or Math



New Studies Monitor Talent Flow into Technical Fields

Two recent ETS studies sponsored by the National Science Foundation examined SAT data between 1975 and 1986 to uncover trends in the numbers, scores, and demographic characteristics of students planning to major in math, science, or engineering. The studies, *Trends in the Selection of Science, Mathematics, or Engineering as Major Fields of Study Among Top-Scoring SAT Takers* (RR-87-39) and *Ten-Year Trends in SAT Scores and Other Characteristics of High School Seniors Taking the SAT and Planning to Study Mathematics, Science, or Engineering* (RR-87-49), were conducted by ETS researcher Jerilee Grandy.

Grandy's first report examined the academic field preferences of students scoring in the top 10 percent on the SAT during the last decade. Compared with other examinees, the high-scoring students were more likely to choose a math, science, or engineering major. Figure 8 shows the most popular field selections for 1986. Other findings are:

- The proportion of the talented tenth selecting one of these technical areas increased until 1982 and then began to decline.
- There were differences between top-scoring males and females.

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In 1986 only 34 percent of the females selected a major in math, science, or engineering compared with 55 percent of the males. Moreover, only 15 percent of the females with the highest mathematical aptitude planned to enter one of these highly quantitative fields.

- There was a shift in the proportions of high-scoring students planning majors in math, science, or engineering. During the past decade, the proportion planning to study engineering rose from 33 to 47 percent.
- There was a clear increase in the number of top-scoring examinees planning to study engineering and business, and there were declines in the more quantitative sciences and in the health fields other than premedicine. Business was more attractive to White female students and Black students of both sexes than to White male students.

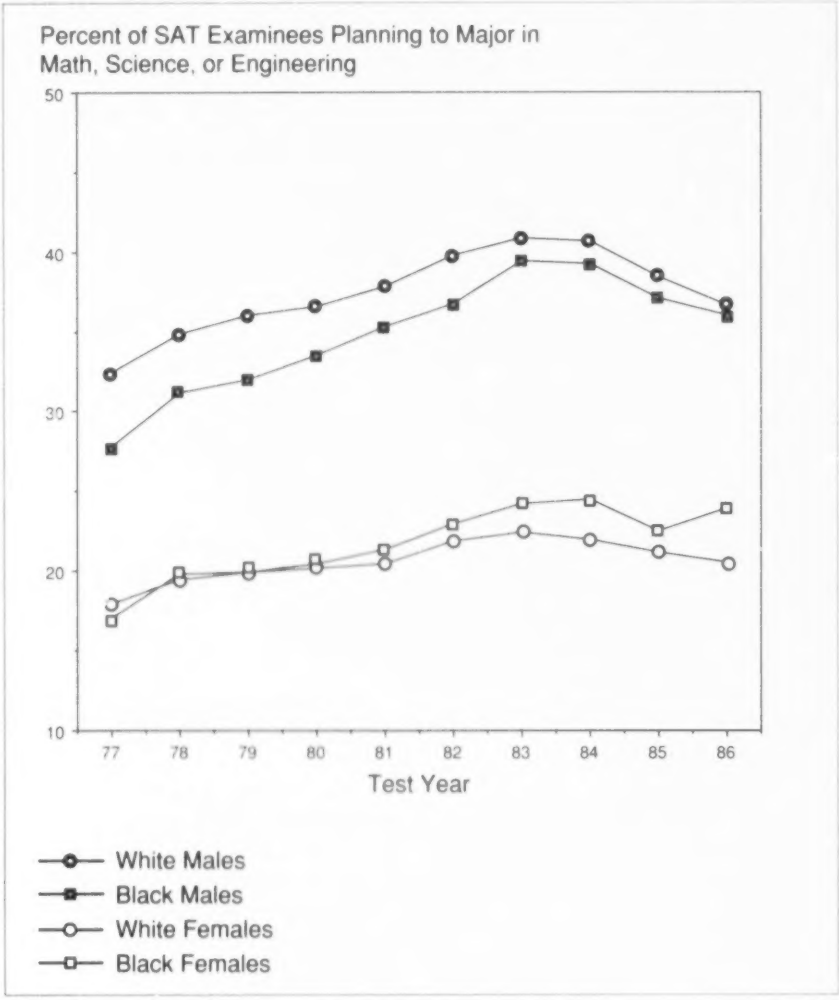
The second study focused on *all* SAT test takers planning to major in math, science, or engineering between 1975 and 1986. This number increased until 1983 and has since declined. There are still more males than females interested in these fields, and women do not seem to be catching up. Figure 9 shows interest in these career areas by sex and race.

While there is still only one female for every five males planning to major in engineering, the average SAT math score for females majoring in engineering has been consistently higher than the average math score for males during the past decade. This has been true for both Whites and Blacks. Female superiority in math is shown specifically among students planning to study electrical, mechanical, and civil engineering.

Other findings:

- The fields of aerospace, electrical engineering, and international relations showed steady increases while interest in computer science declined 49 percent in the last three years.
- In 1986 examinees planning math, science, or engineering majors had SAT verbal scores that were 26 points higher and math scores that were 53 points higher than the average score for all test takers.
- Mean SAT math scores of Black students planning to major in math, science, or engineering rose 15 points over the past decade.

Figure 9



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Black College Faculty (continued from page 1)

Brown reports that Black faculty have the lowest promotion, retention, and tenure rates of any group. The shortage of Black faculty is a problem not only of supply, but also of flow into and through the academic pipeline.

Recommended Policy Directions

The author, an associate professor of sociology at the University of Maryland, notes that current policies and practices are not working effectively and that other strategies must be employed to increase Black representation on college faculties. Policy recommendations include:

- Initiatives for enhancing minority postsecondary enrollment must be at the top of national and state political agendas.
- Effective consortia of traditionally Black and predominantly White colleges are needed to attract minority students into graduate programs.
- Foundations and other organizations must increase fellowships and training programs to support minority students who plan academic careers.
- Black Ph.D. candidates must be encouraged to make career choices in expanding fields like science and technology.
- Colleges and universities must make special efforts to retain Black faculty through the winnowing processes of promotion and tenure.

Brown's study was supported jointly by the Graduate Record Examinations Board and Educational Testing Service. For a copy, write to Graduate Record Examinations Program, Mail Stop 29-P, Educational Testing Service, Rosedale Road, Princeton, NJ, 08541-0001.

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ETS POLICY NOTES

News from the ETS Policy Information Center

Volume I, Number 2 | Educational Testing Service, Princeton, New Jersey | March 1989

This Issue: From High School to College

- Edging Forward
  — Toward more academic courses in high school, narrower gaps between minority and majority SAT scores.
- A Right Start
  — Who gets guidance counseling in choosing the high school curriculum, and what is the result?
- High Achievers
  — High-achieving Hispanic students and how they compare.

Starting on the Right Track

A new study by ETS researchers Ruth Ekstrom and Valerie Lee finds that guidance counseling is not equally available to all secondary students, even at times when they must make crucial educational decisions.

Guidance counselors can — and often do — have a significant influence on several critical choices that shape the futures of the students they advise. These include: (1) the curriculum track students enroll in, (2) the courses

(continued on page 5)

Edging Forward: What the SAT Shows About College-Bound Seniors in the 1980s

A dozen years ago, the publication of *On Further Examination*, the report of a Blue Ribbon Panel created by the College Board and Educational Testing Service, called attention to the decline of American education. Charged with determining why Scholastic Aptitude Test (SAT) scores were falling, the panel concluded that the 14-year drop was significant but not irreversible. Subsequently, a series of hard-hitting state and national reports, including the 1983 report of the National Commission on Excellence in Education, spurred a wave of reforms that has come to be known as "the excellence movement."

The SAT is a measure of developed abilities that is taken by more than a million college-bound seniors each year. Information we have about the characteristics of SAT-takers comes from the Student Descriptive Questionnaire that test takers fill out voluntarily; 95 percent did so in 1988. Although reasoning skills measured by the SAT develop over a period of time, a brief look at SAT data trends over the last decade reveals some signs that the educational reform movement is beginning to have an impact on student performance.

The low watermark in SAT scores for college-bound seniors was reached in 1980. Average scores of 424 in verbal and 466 in mathematical ability represented declines of 42 and 26 points, respectively, from average scores in 1967. After holding at those 1980 levels for one more year, verbal scores remained essentially flat through 1988 while math scores increased to 476.

Welcome Gains

Averages often conceal as much as they reveal, and this is strikingly the case with SAT scores over the last decade. The data below reveal a lot about the location of educational progress in what is an increasingly multiracial/ethnic/cultural society. An essentially stable average performance for White students contrasts with slight to considerable gains for students from minority groups. Figure 1 shows the change from 1978 to 1988 in average SAT verbal and math scores for each racial/ethnic group.

For verbal scores, the static performance of White college-bound seniors (as well as the average for all students) contrasts with slight gains among Puerto Rican and American-Indian

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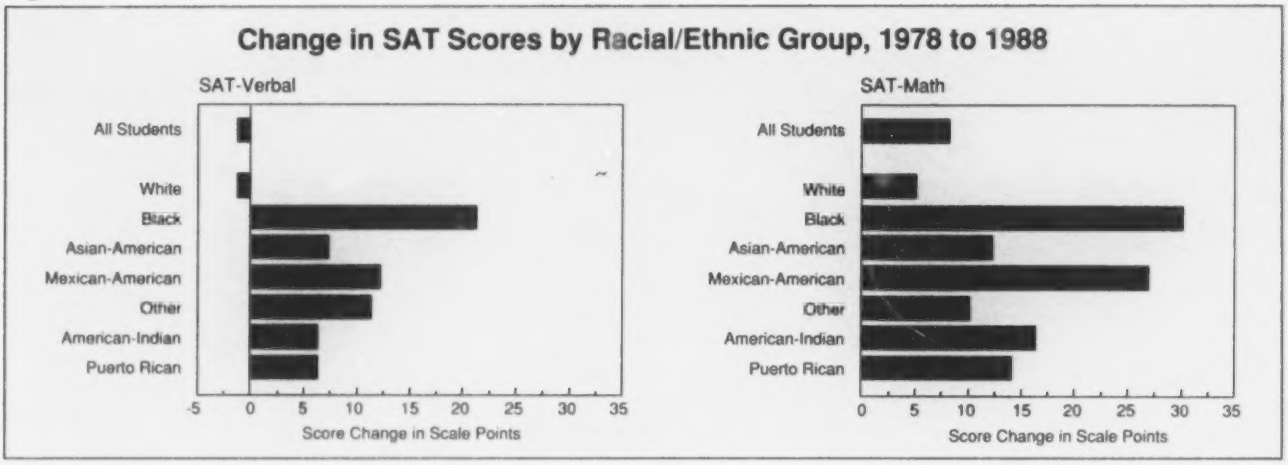
Figure 1



seniors, with moderate gains among Mexican-American seniors, and with considerable gains among Black seniors. It is not a simple matter to convey the significance of these gains, since this is accurately determined only in statistical terms. Some perspective, however, is provided by the following: The Black seniors' gain of 21 scale points on the verbal test is half the 42-point decline for all students from 1967 to 1980.

Overall, mathematics scores among all groups increased a modest 8 points. However, all minority groups had greater gains. Asian-American, Puerto Rican, and American-Indian seniors gained 12, 14, and 16 points, respectively. Twenty-six- and 30-point gains were registered by Mexican-American and Black seniors.

While education reform efforts have not yet shown a dramatic effect on the average performance of all college-bound seniors, and SAT score changes cannot be linked to specific reform measures, upward movement among racial and ethnic groups whose average performance has long been well below average is encouraging. During the last decade, these groups have also registered improved scores in the "Report Cards" of the National Assessment of Educational Progress (NAEP), although these gains have been registered largely at the lower end of the performance scale. With the average achievement for the White majority essentially flat, some progress is being made in the direction of parity.

The Gap Remains

With the SAT averages for these minority students showing improvement and the average for White seniors stable or slightly increasing, it is reasonable to wonder why the averages for students as a whole show such little upward movement. The answer to that question indicates the magnitude of the task the nation faces in developing its talent to meet the challenges of the next century. Minority students (except for Asian-American seniors in mathematics) score much lower, on average, than the majority, even though their scores are advancing; since they are a minority, their score gains have little effect on the overall average. They are also an ever-increasing proportion of all students, and their lower average scores hold down the national average. In 1975, minority SAT-takers comprised just 14 percent of the total; by 1982 they were 18 percent, and by 1988 they were 23 percent. When releasing the 1988 SAT results, Donald Stewart, president of the College Board, said, "If the gap between minority and majority test scores is ever to be closed, improvements in the elementary and secondary education of minority students must be accelerated." The gains being made should not overshadow the distance left to go, as illustrated in Figure 2.

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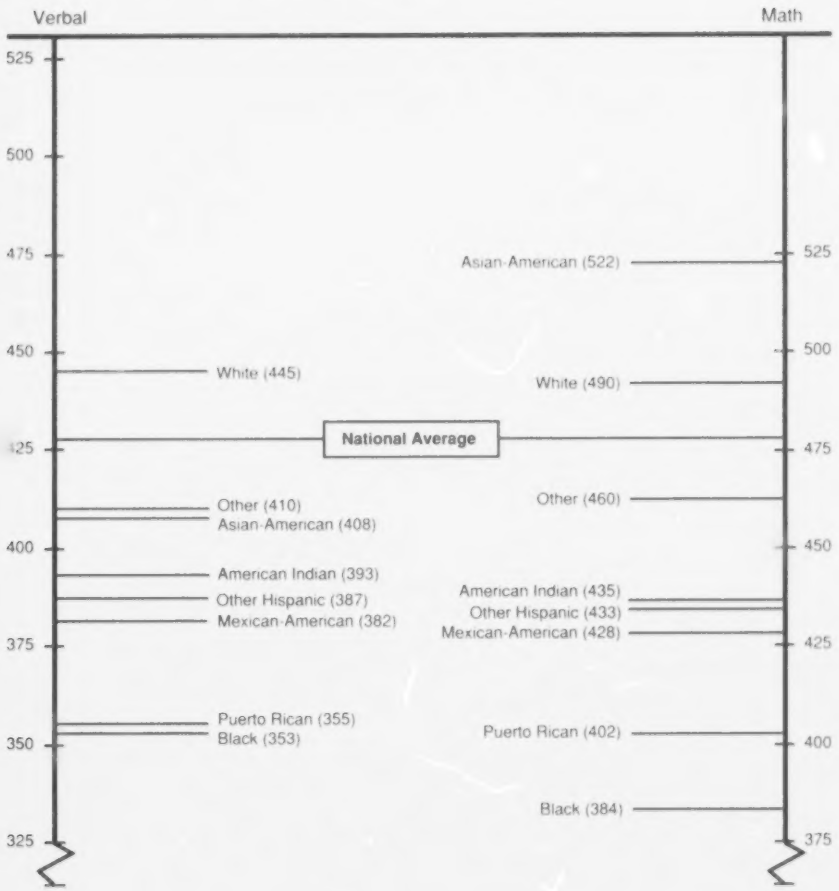
Figure 2
Average Scores by Racial/Ethnic Group, 1988



This gap in SAT performance continues to mirror family socio-economic and educational status as illustrated in Table 1 below.

Table 1

	Percent, Parents with Annual Income Below $20,000	Percent, Highest Level of Parent Education, High School Diploma or Less
All Seniors	18%	41%
White	12	38
Black	41	59
Asian-American	31	38
Hispanic	40	61
American-Indian	20	49

If You Take the Courses. . .

In this brief report it is not possible to explore fully the reasons for the improvement we have seen or (in the case of White college-bound seniors) not seen. It is, however, generally agreed that taking academic courses is directly related to performance. A glance at Figure 3 provides one basis for this judgment: As the number of years of study rises in six academic subjects (Arts & Music, English, Foreign Language, Mathematics, Natural Sciences, and Social Sciences/History), so do the scores on the SAT.

Seniors who took less than 15 course-years of study in these six subjects in high school had average scores of 359 in verbal ability and 399 in mathematical ability. Each jump in course-taking is accompanied by increases in both scores. Students who took 20 or more course-years of study had average scores of 478 and 530.

The "excellence movement" of the 1980s has focused on increasing academic course-taking in high schools. States have generally followed this advice, and requirements for high school graduation have increased. An added impetus for taking more academic courses has been additional course requirements for admission to many colleges and universities, as they attempt to return more rigor to higher education.

Did 1988's college-bound seniors take more academic courses than their recent predecessors, as recommended by the National Commission on Excellence in Education? Figure 4 indicates that, except for English, this year's seniors taking the SAT did come closer to meeting the

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commission's recommendations for the college-bound: four years of English, three years of social studies, three years of mathematics, three years of science, and two years of foreign language.

There is clear progress toward the goal of three years of mathematics during high school, with 94 percent of college-bound seniors meeting it in 1988, up sharply from 82 percent in 1975. The percentage of students taking three years of social studies edged up. After a drop in the percentage taking two years of foreign language between 1975 and 1982, there was a rebound in 1985, and the 1975 number was surpassed. Comparable information is not available from the SAT-takers about science courses for 1975 and 1982, but one-fourth were not taking the recommended three years in 1988. English course-taking has slipped back to the 1975 rate after moving up a bit from 1975 to 1982.

It is not possible to draw a cause-and-effect relationship between course-taking and scores over this period because a number of factors undoubtedly influenced scores and course-taking. However, given the close relationship between course-taking and SAT scores (demonstrated above), it is reasonable to conclude that beefing up the content of high school education is showing some results, particularly in light of related NAEP studies and data from the National Longitudinal Survey.

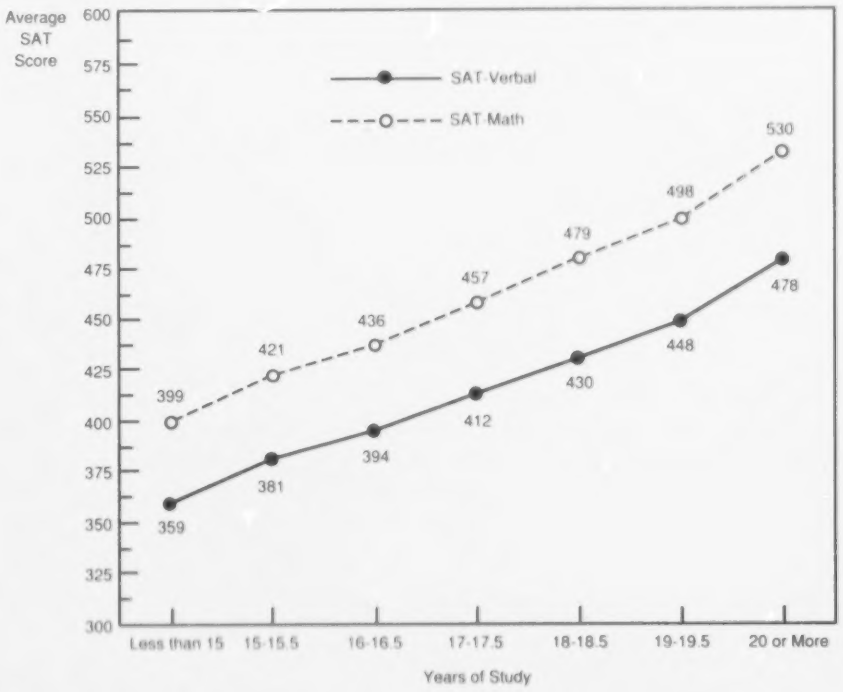
Catching Up

Course-taking patterns by race and ethnicity are also revealing. Between 1982 and 1988 there was considerable movement toward parity in the quantity of college-preparatory course-taking, although it is not yet fully achieved. The gap, in this brief six-year period, has greatly narrowed among SAT-takers.

- Three Years of Mathematics — All groups increased substantially, and minority groups surged enough to draw nearly even. By 1988, compliance with this recommendation ranged from 91 to 96 percent.
- Three Years of Social Studies — While the improvement was not large, the range in 1988 was from 80 to 85 percent, compared to from 74 to 82 percent six years earlier.
- Two Years of Foreign Language — Black seniors jumped from 59 to 75 percent, still lagging 12 percentage points behind White seniors; American-Indian seniors moved from 61 to 78 percent. Hispanic and Asian-American seniors are about even with White seniors.
- Three Years of Science — No comparable information was available for 1982. In 1988, congruence with the recommendation ranged from 68 to 79 percent, with Asian-American seniors the highest.

(continued on page 7)

Figure 3
Average SAT* Scores by Years of Study in Six Academic Subjects*



*Arts and Music, English, Foreign Language, Mathematics, Natural Sciences, and Social Sciences and History.
Source: "News from the College Board," September 20, 1988.

Right Track

(continued from page 1)

they take, and (3) what they do when they complete high school. Yet, many students never see a guidance counselor when making these decisions, and often the choices are made for them.

Curriculum

The choice of a curriculum track — academic, general, or vocational — is critical because only those in the academic track are fully prepared to enter college when they graduate from high school. Yet, many students do not choose a curriculum track; they are assigned to one. Analysis of data from the High School and Beyond study revealed that:

- Forty-three percent in the general track said they had been assigned there, compared with 37 percent in the vocational track and 33 percent in the academic track. Minority students were much more likely to be assigned to a curriculum than White students; for example, 52 percent of Black students were assigned to, rather than chose, their high school curriculum track, compared to 36 percent of White students.
- Less than a quarter had help from a guidance counselor in selecting a curriculum track. About three out of every 10 students in the academic track chose their curriculum with the help of a counselor, compared to two out of 10 in the general and vocational tracks.
- About a quarter of the students in each curriculum track said they made this choice alone, without advice or help from a counselor or parents.
- Students with higher socioeconomic status and greater access to guidance counseling were more likely to be enrolled in the academic curriculum.

Course Planning

About half of the students said that they had no access to a guidance counselor when deciding what courses to take. Students making a choice were most likely to discuss their course-taking plans with their mothers, then with their fathers, next with guidance counselors, and least with teachers.

Access to guidance counseling for course planning is not evenly distributed either.

- Students who have high tested achievement in grade 10, come from affluent families and large high schools, and plan to attend four-year colleges were more likely to have access to this kind of counseling.
- Minority and rural students had less access to counseling in planning their high school programs.

The investigators conclude that "guidance counseling appears to be an important conduit towards academic pursuits." Further, students with greater access to guidance counseling took significantly more courses in mathematics.

Post-High School Plans

Guidance counselors also help students make plans for college or a job after high school. This type of counseling was slightly more available than counseling for course planning. However, four out of every 10 had no help from a counselor in making post-high school plans.

Black students, students planning to attend four-year colleges, and students in the academic track were more likely to receive this type of counseling, while students in the general track had less access. Since students in the general track are being prepared for neither college entry nor occupations, it is particularly worrisome that they are the ones with least access to counseling on post-high school plans.

Summary

"Overall," the authors conclude, "despite our inability in this study to address questions about the content of guidance counseling, we have discovered that access appears to be available on a somewhat inequitable basis. Less affluent students, more likely to come from minority backgrounds, less likely to have college aspirations, more likely to be in rural and smaller schools, do not have equal access to counseling for selecting their curriculum track and planning their school program at high school entrance. At the point of high school exit, students in nonacademic curriculum tracks are less likely to be influenced by counseling to plan their education or career futures."

For the full report, see Valerie E. Lee (now at the University of Michigan) and Ruth B. Ekstrom, "Student Access to Guidance Counseling in High School," *American Educational Research Journal*, Summer 1987, Vol. 24., No. 2, pp. 287-310. This research was jointly supported by the College Board Commission for the Study of Precollege Guidance and Counseling and Educational Testing Service.

Clarification:

A chart comparing average SAT scores and expenditures for education appeared in ETS Policy Notes, Vol. 1, No. 1. It cited the (National) Center for Education Statistics as its source. The data on which the chart was based were from the Center, but the chart itself was not.

High-Achieving Hispanic Students

By the year 1992, the percentage of high school graduates who are Hispanic could increase from the current level of about six percent to 15 percent. Such an increase has serious implications for the educational system, the well-being of Hispanics as a group, and the progress of the U.S. as a democratic, pluralistic society. Yet research about Hispanics is limited and usually focuses on their rates of participation, attrition, and field choice in higher education. Little is known about high-achieving Hispanic students, their characteristics, the types of high schools they attend, and how these students perform in college.

Recently, however, the College Board and ETS published a study by Beatriz Chu Clewell and Myra Ficklen Joy that describes the first cohort of applicants for the National Hispanic Scholar Awards. With funding from the Andrew E. Mellon Foundation, the National Hispanic Scholar Awards Program was started in 1983 as an effort to enhance Hispanic participation in baccalaureate programs. It provides awards of $1,500 to high-achieving Hispanic students who plan to attend four-year colleges. All students who were invited to apply and did so were considered to be semifinalists.

Using data from both the Student Descriptive Questionnaire (SDQ) of the SAT and responses to a questionnaire mailed to all program applicants, the researchers were able to profile the demographic and educational background of high-achieving Hispanic students, as well as compare them to all Hispanic and White SAT-takers. Findings show that the first group of applicants to the awards program differed markedly from these groups in several ways:

- Most applicants were from families whose income and education levels were above average for Hispanic SAT-takers. More than 40 percent had fathers with college degrees and more than 30 percent had mothers who held at least baccalaureate degrees. The median family income of the applicants was over $30,000, compared with $19,900 for all Mexican-American SAT-takers and $14,600 for all Puerto Rican SAT-takers. More than half the applicants indicated that their fathers held positions as professionals or managers and owners of businesses.
- Most applicants were from homes where English or both English and Spanish were spoken, and they rated their English skills as very good. Many had some facility in Spanish as well but appeared to use English as the dominant language.
- Nearly all applicants (more than 95 percent) were in an academic or college-preparatory track, compared to 80 percent of all Mexican-American SAT-takers and 77 percent of all Puerto Rican SAT-takers. The applicants also took more academic courses in high school.
- The majority of Hispanic students in the U.S. attend high schools where more than half the students are Hispanic. In contrast, more than three-fourths of the National Hispanic Scholar Awards applicants attended high schools where fewer than 50 percent of their classmates were Hispanic. However, most of the applicants had at least one Hispanic teacher or guidance counselor, although many did not.
- The applicants earned grade-point averages and SAT scores substantially above the average for all Hispanic SAT-takers and above the average for White SAT-takers as well.
- A majority of applicants attended selective colleges more than 100 miles from home. Applicants encountered few problems in adjusting to college and performed well their first year, based on self-reported grades.
- Despite relatively high family incomes, most applicants received financial aid and owed some money at the end of their freshman year.
- A higher percentage of applicants than of all Hispanic or White SAT-takers planned to major in scientific and technical fields.

For the full report, see Beatriz Chu Clewell and Myra Ficklen Joy, *The National Hispanic Scholars Awards Program: A Descriptive Analysis of High Achieving Hispanic Students*, College Board Report No. 88-10 and ETS Research Report 88- 56, 1988. Copies are available by ETS R-R Number from:

Research Publications, 05-R
Educational Testing Service
Rosedale Road
Princeton, NJ 08541-0001

Edging Forward . . .

(continued from page 4)

- Four Years of English — All groups dropped back in meeting this recommendation, although Hispanic seniors by only one percentage point. Majority students dropped most.

It is likely more than coincidental that the increases in course-taking on the part of minority students were accompanied by increases in their SAT scores. While this is a reassuring development, it is, again, only a measure of the quantity of courses taken in high school; these data tell nothing about course quality or about preparation before and outside of high school. It is known that the gap in scores between minority and majority students (except for Asian-American seniors) remains large, even though there is much greater parity in meeting the recommendations of the Excellence Commission. This may suggest that minority students came into high school with greater educational deficits and got less from these courses.

Although minorities have progressed toward the recommended level of courses in individual subject areas, the total number of academic courses taken in six core subject areas reveals a still considerable gap between majority and minority students, and this gap is also a suspect in the remaining score differentials. This can be seen in the comparisons presented below in Table 2.

While more minority students are meeting the recommended numbers of courses, White and Asian-American seniors are more fre-

Figure 4
Percent of College-Bound Seniors Meeting NCEE Curriculum Recommendations, 1975, 1982, 1988

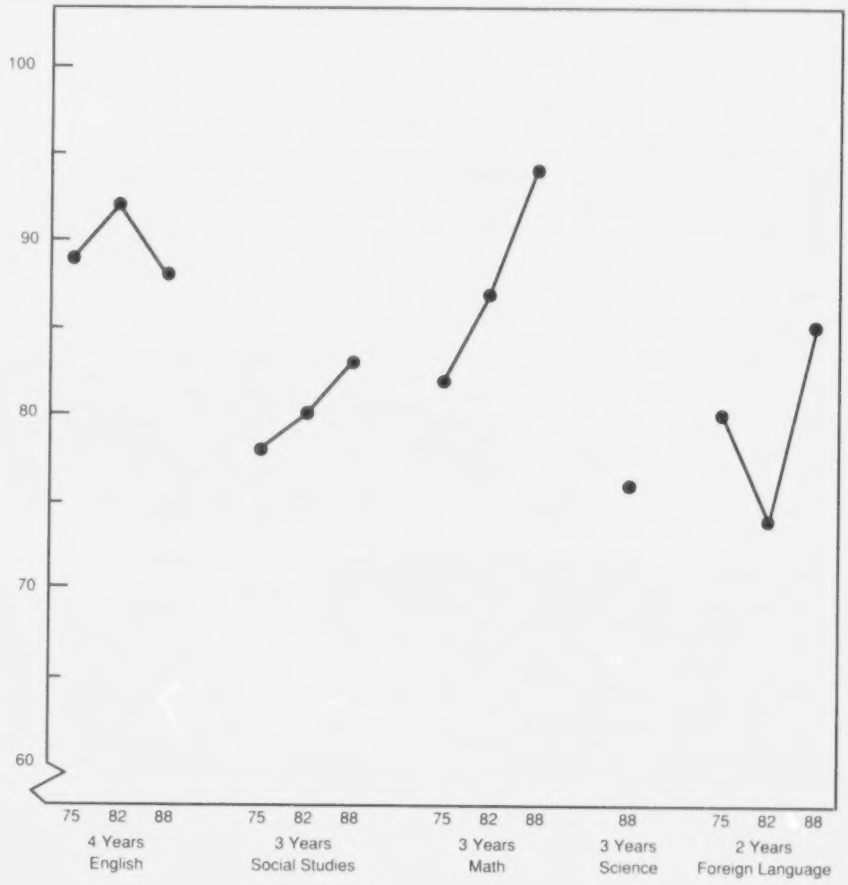


Table 2

	Percent Taking 20 or More Academic Courses	Percent Taking Fewer Than 15 Academic Courses
All Seniors	36%	11%
White	37	10
Black	24	20
Asian-American	41	10
Hispanic	27	14
American-Indian	25	17

quently exceeding them, and on average taking more subjects in all six core academic areas combined.

Aspirations

SAT-taking seniors are asked to specify the highest level of education they plan to complete beyond high school. Aspirations remained basically stable from 1982 to 1988, and considerably higher than will likely be realized. Aspirations exceeding accomplishments has long been observed, particularly in studies such as the National Longitudinal Survey of 1972, where seniors were followed into their young adult years.

Most striking, but also not surprising, is the fact that minority seniors do not plan to pursue less education than do majority students; in fact, their goals are higher (see Table 3).

Many surveys in different fields have found a commonality of aspirations in America. Differences remain, however, in their realization. When high school seniors take the SAT, their aspirations have not yet been dulled by adverse experience. This, itself, is a basis for continuing to believe, as did the Blue Ribbon Panel chaired by Willard Wirtz a decade ago, that nothing in the record discourages "the conviction that learning in America can be made all that is hoped for."

Table 3

	Percent With Goals of Master's or Doctoral Degree
All Seniors	45%
White	42
Black	50
Asian-American	57
Hispanic	51
American-Indian	37

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ETS POLICY NOTES

News from the ETS Policy Information Center

Volume I, Number 3 | Educational Testing Service, Princeton, New Jersey | June 1989

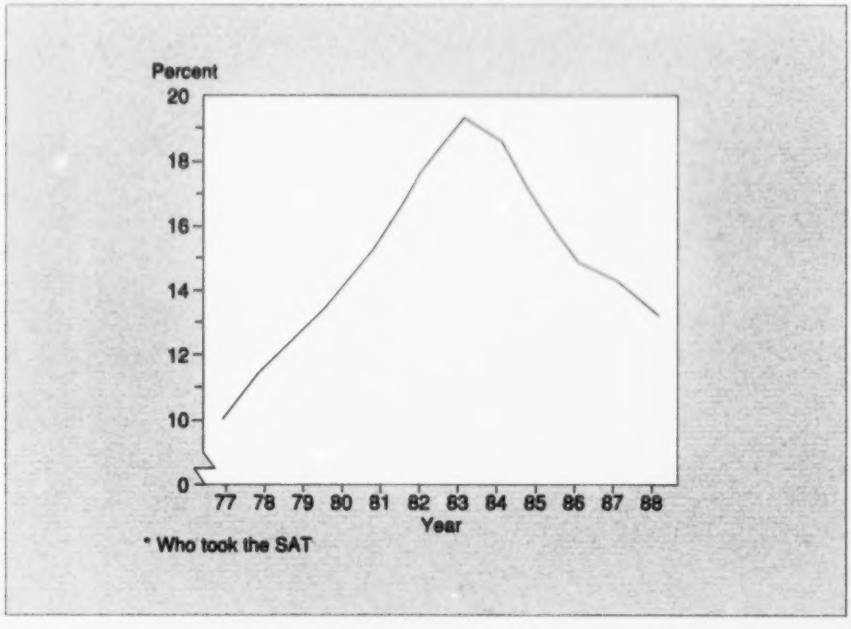
This Issue: Science

- A Precious Few
  — Decline in high school seniors planning majors in math, science, and engineering
- A Straggler's View
  — How we compare — an international assessment
- Staying Power
  — High ability high school students who persist in their plans

A Precious Few: Interest of the College-Bound in the Quantitative Sciences

As noted by such groups as the Task Force on Women, Minorities, and the Handicapped in Science and Technology, our nation's scientific and engineering work force is eroding due to retirements and declining student interest. Between 1985 and the year 2000, 85 percent of new entrants to the labor force will be members of minority groups and women — groups historically underrepresented in science and engineering. Data drawn from a National Science Foundation study by ETS researcher Jerilee Grandy illuminate trends in the supply of potential scientists and engineers coming out of an important part of the education pipeline, high school. The bottom line is that the interest of seniors taking the SAT in pursuing the quantitative sciences has been dropping since 1983 (see Figure 1). The Grandy study is based on data amassed during a

Figure 1
Percent of College-Bound Seniors* Intending to Major in a Quantitative Science, 1977 to 1988



A Straggler's View: The U.S. in the World of Science Education

"We live in a society — and a nation, and a world — exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology."

Noted astronomer Carl Sagan made that comment during a press conference held last September to introduce the report of the National Assessment of Educational Progress (NAEP) on its 1986 survey of science learning among American students. Four months

(continued on page 5)

Figure 2
Percent of College-Bound Seniors* Intending to Major in a Quantitative Science, by Field, 1977 to 1988

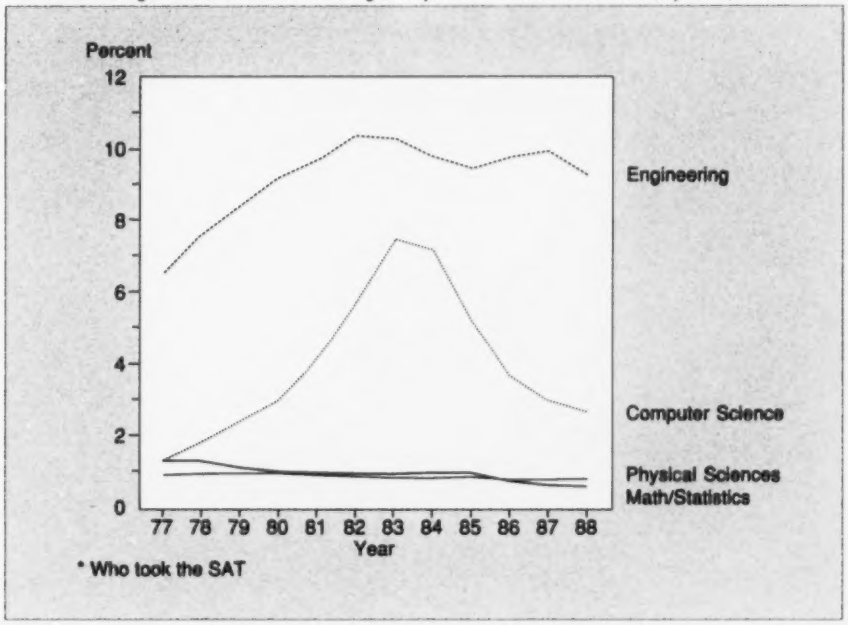
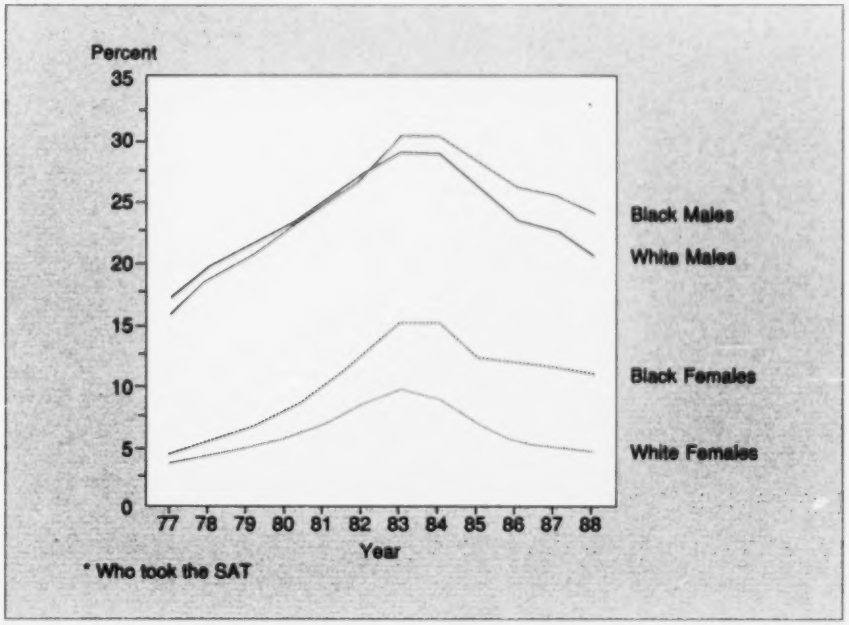


Figure 3
Percent of College-Bound Seniors* Planning to Major in a Quantitative Science, by Sex and Race, 1977-1988



period of 11 years on the plans of college-bound seniors taking the Scholastic Aptitude Test (SAT), and it includes information by race and sex.

Overall Trends: Fewer and Fewer

There was a rise and then a decline in both numbers and percentages of SAT-takers interested in the more quantitative sciences — math and statistics, the physical sciences, engineering, and computer science — during this 11-year period. Similar trends are evident from other data sources. After doubling between 1977 and 1983 and peaking at almost 20 percent, the proportion of high school seniors taking the SAT and planning quantitative science majors gradually declined to about 13 percent in 1988. This trend is shown in Figure 1.

There are large differences in student interest among these four quantitative fields. Figure 2 shows trend lines for each of the four fields. Interest in math or statistics is minute and declining. In 1988 about six out of 1,000 college-bound seniors expressed an interest in these college majors down from about 13 of 1,000 in 1977. While interest in the physical sciences has been relatively stable, only about eight of 1,000 seniors have planned these majors. Interest in computer science has dropped from a high point of about seven percent during the early 1980s to less than three percent in 1988. Engineering, the most attractive of the quantitative fields, has held its own since the early 1980s at between nine and 10 percent, up from about six percent in 1977.

All Groups Down

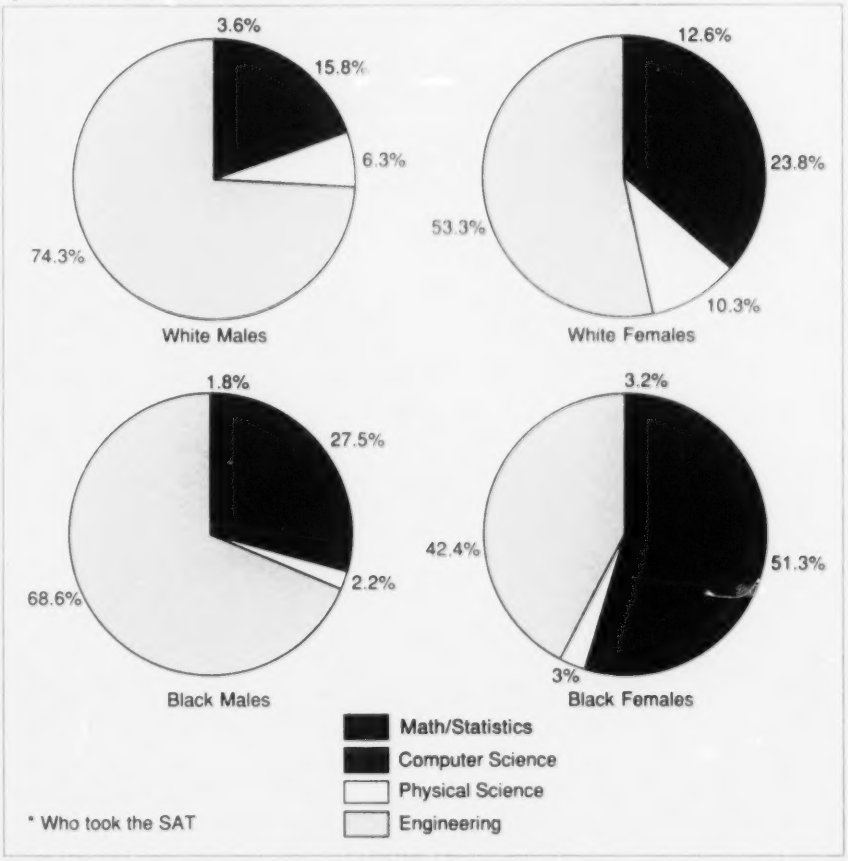
Trend data are also available for four subgroups of students — White males and females, and Black males and females. Because of their relatively small numbers, data for members of other racial/ethnic groups were not analyzed separately. Figure 3 shows trends in the percentage of each of these subgroups expressing an interest in a quantitative science. Interest rose among all four groups during the late 1970s and early 1980s and has declined since. In 1988, 24 percent of the Black males and 21 percent of White males intended to major in a quantitative science. Interest in these increasingly critical areas among female examinees was alarmingly low, with 11 percent of Black females and only five percent of White females planning to major in one of them.

Also worth noting are differences among these groups in choices of majors *within* the quantitative sciences, as shown in the charts in Figure 4. Males, both White and Black, were more likely to be interested in the applied engineering fields than were the females. Of Black females choosing the quantitative sciences, fully half were interested in computer science, compared to a quarter or fewer of the other students. Interestingly, White females headed for the quantitative sciences were more likely than others to express interest in math, statistics, and the physical sciences.

While there is no guarantee that students will actually major in the fields they specify, the choices they make when they take the SAT provide an indication of their interests at that time and reflect the decisions they have made thus far regarding their educational futures. According to Grandy, who has studied the supply of future mathematicians, scientists, and engineers for many years, "With the patterns of interest in science well established, and the trends not at all favorable to our national interest, we need to probe more deeply into why qualified people are turning away from science in this decade. We need information we can use, and in time to expand the horizons of these students, particularly women and minority students."

Copies of the report from which the data in this article are drawn, "Trends in SAT Scores and Other Characteristics of Examinees Planning to Major in Mathematics, Science, or Engineering," are available from: Research Publications, 05-R, Educational Testing Service, Rosedale Road, Princeton, NJ 08541. Order No. RR-89-24.

Figure 4
Distribution of College-Bound Seniors'* Intended Majors within Quantitative Fields, by Sex and Race, 1988



Staying Power: Students Who Persist

As the United States searches for ways to increase its supply of mathematicians, scientists, and engineers, it is critical to interest high-ability high school students in those careers. But that's only half the battle: they have to maintain that interest into college and stay with it. How many do? Are minority students who test high in ability more or less likely to persist in preparing for these fields? How do those who do persist differ from those who don't?

These questions were explored by a team of ETS researchers led by Thomas L. Hilton and Jayjia Hsia in a study funded by the National Science Foundation and ETS. The subjects of the study were 6,100 young people who scored 550 or above in mathematics on the Scholastic Aptitude Test (SAT) in 1985 and said they intended to major in math, science, or engineering. What the study found is encouraging, and it also points education institutions toward policies that will help keep students in these critical fields.

Of the high-ability Black and Puerto Rican students, 62 percent enrolled in college and were still pursuing their academic work in these fields two years later. Fifty-eight percent of Mexican-American students had persisted, as had 56 percent of American Indian students and 55 percent of White students. The authors concluded: "The analysis ...indicated that the high-ability minority students persisted...to an unusually high degree."

The students who dropped out along the way did so for a combination of individual and environmental reasons. Those who transferred to other fields had less science motivation, but had relatively high abilities in other areas. The rest, in addition to lacking science motivation, had relatively low educational and professional aspirations and low actual achievement in mathematics.

Those who persisted were different from those who did not in several important respects:

- In high school they had greater participation in math and science clubs.
- They were more likely to have taken Advanced Placement courses in math and science, as well as honor courses.
- They were more likely to have been influenced by college-based programs for recruiting minority students and encouraging their study in a math, science, or engineering field.

The most important predictor of persistence was the nature of the college environment, including factors such as recruitment efforts, retention practices, and the quality of instructional programs.

Having minority role models was confirmed as being important. While parents, friends, and teachers were important, the scientists and engineers the students knew — or met in summer jobs and part-time work — had greater influence. Based on these results, the authors concluded that "high priority should be given to programs that provide promising minority students with opportunities for part-time and summer work in science and engineering."

In releasing the report, the authors said, "The results demonstrate that when minority students have the opportunity to acquire the skills and interests required for successful study in these fields, they persist in their pursuit of such careers to a degree that is equal to or greater than that of White students."

For the full report, see Thomas L. Hilton, Jayjia Hsia, Daniel G. Solorzano, and Nancy L. Benton, *Persistence in Science of High-Ability Minority Students*, Educational Testing Service. Copies of the 258-page report may be ordered by sending $16.00 (make check payable to ETS) to Publications Order Services, ETS, P.O. Box 6736, Princeton, N.J. 08541-6736.

A Straggler's View: The U.S. in the World of Science Education

(continued from page 1)

later, Sagan's point was driven home with the release of the ETS report, *A World of Differences*; showing that 13-year-old Americans were one of the lowest achieving groups in math and science among 12 student populations sampled around the world.

That was one result of the first International Assessment of Educational Progress (IAEP) conducted by ETS, which also administers NAEP, a 20-year project funded by the U.S. Department of Education. The IAEP report put the U.S. ninth out of 12 groups in science and last in mathematics.* Other international assessments involving more nations have been conducted by the International Association for the Evaluation of Educational Achievement, and they have yielded similar results.

Table 1

Rank of United States in 12 Country Assessment*	
Mathematics	**U.S. Rank**
Problem Solving	11th
Routine Application	12th
Understanding and Comprehension	12th
Skill	12th
Knowledge	11th
Science	
Knows Science	10th
Uses Science	10th
Integrates	10th

*Several countries, including the U.S., had scores close together or essentially the same, and are best referred to as being in the "lowest performing group."

Using science and math questions from NAEP's 1986 surveys, the IAEP study was noteworthy on two counts: Results were reported within a year after data collection, and scores were reported on a new proficiency scale that describes what students know and can do at different levels of performance. The IAEP study included British Columbia, Ireland, Korea, New Brunswick (English), New Brunswick (French), Ontario (English), Ontario (French), Quebec (English), Quebec (French), Spain, United Kingdom,** and the United States.

The Nation Responds

These findings come as no surprise. During the last few years, intense efforts have gone into reforming elementary and secondary education to provide students with the technological skills necessary to strengthen our position in increasingly fierce international economic competition. Several blueprints for restructuring education have emerged from this work.

In 1988, the Office of Technology Assessment published two reports, *Educating Scientists and Engineers: Grade School to Grad School* and *Elementary and Secondary Education for Science and Engineering*. After long deliberation, the National Council of Teachers of Mathematics prescribed, early this year, new objectives for the teaching of elementary and secondary school mathematics. This work was germane to the development of the objectives that will guide the 1990 national assessment of mathematics, an assessment which, by Act of Congress, will include separate assessments in cooperating U.S. states and jurisdictions (41 volunteered to participate).

Also early in 1989, the American Association for the Advancement of Science issued its "Project 2061" report, *Science for All Americans*, inaugurating a long-range program to restructure precollege education; in fact, the project is titled "2061" because Haley's Comet returns that year. In releasing this report, the project director, F. James Rutherford, set an ambitious agenda: "The goal of Project 2061 is to bring about major changes in precollege science, mathematics, and technology education in the United States: What needs to be learned, how that can best be taught, and

"Is the sun new every day, as the old philosopher asked? How could you tell, one way or the other? *Something* is new every day; the exciting path of seeking and using a new experience as evidence to draw out tentative answers, old and new, is the way of science. That path leads well beyond the sciences, too, in a direction our schools need to follow."

Philip Morrison, Physicist, and Phyllis Morrison, Educator

**The United Kingdom sample was drawn from England, Scotland, and Wales.

A Straggler's View:

(continued from page 5)

ultimately how to convert these recommendations into practical, working programs for U.S. schools."

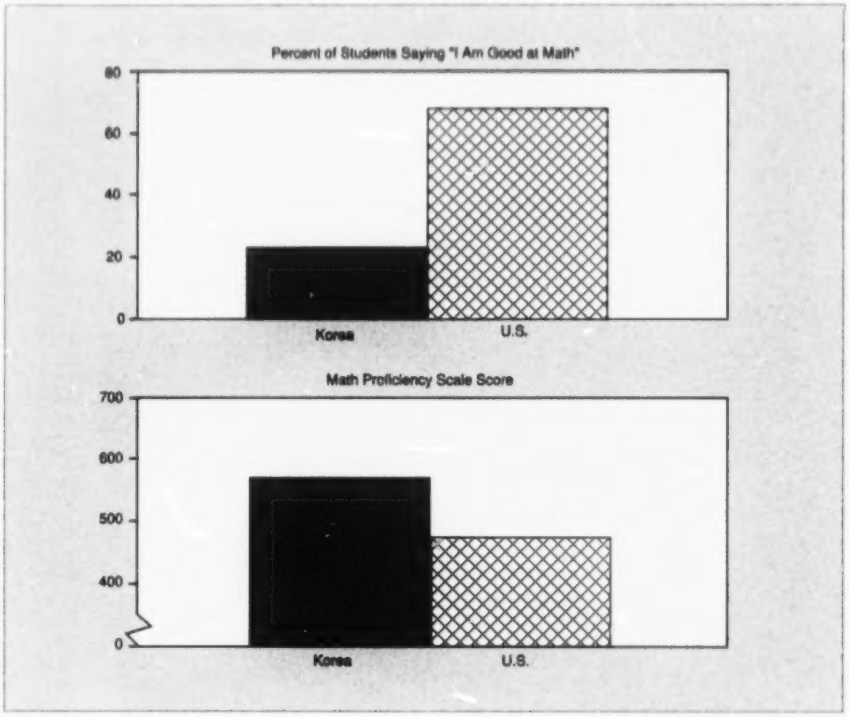
In this article, we will present some information from the ETS international assessment that was not included in *A World of Differences*, and highlight some findings from the U.S. perspective.

Thinking in Math and Science

A common thread through all educational assessments is the distinction between the mastery of basic knowledge (where American students have generally improved) and the ability to think, analyze, and synthesize (where American performance is low and generally stagnant). While the terms used often differ — problem-solving ability, higher-order skills, or critical thinking — a consensus has emerged that we are deficient at this important end of the achievement spectrum. NAEP's *Science Report Card* put it this way: "Our nation is producing a generation of students who lack the intellectual skills necessary to assess the validity of evidence or the logic of arguments."

The ETS international assessment provides information on performance at different cognitive levels in mathematics and science, as well as in various subtopics reported in *A World of Differences*. A glance at Table 1 reveals that the United States ranks near the bottom in all cognitive areas of mathematics, and near the bottom in the science areas.

Figure 5
Students' Perception of Math Proficiency Compared with Measured Proficiency, Korea and the U.S.



Unfortunately, we cannot make the statement that we are poor in some areas but considerably better in others.

In mathematics the U.S. is last in the ability to engage in routine manipulation of numbers and in the ability to carry out standard procedures that lead directly to answers. It is virtually at the bottom in "problem solving" requiring higher-order thinking skills to screen relevant from irrelevant information, determine what information is needed to solve a problem, and formulate generalizations.

In science the U.S. was 10th in the ability to recall specific facts and concepts and the ability to demonstrate familiarity with scientific terminology. The U.S. was also 10th in the abilities required to analyze a problem in a manner consistent with the body of scientific concepts, organize a series of logical steps, and draw conclusions on the basis of available data (these descriptions are from the NAEP "objectives" booklets that guided development of the questions for the 1986 assessment).

While there is a "world of differences" in the performance of different student populations there is a sameness to the U.S. position among these groups, irrespective of the cognitive areas assessed.

Perceptions of Performance

Education reforms require more than clearer objectives and better teaching methods, as critical as these are. Our levels of science achievement are dependent upon the interest we have in science as a people and the value we place on the scientific way of thinking. The values of a nation, not just a profession, must be addressed. Korean educators, whose students took the laurels in both science and math, stated that these two subjects are "areas of special interest" and that "scientific and technological areas carry high prestige." Science learning today requires more than textbooks and drill; it requires live experience, and as Philip Morrison, physicist, and Phylis Morrison, educator, recently observed: "Symbols and images are cheap and plentiful, but hands-on realities, heavy, alive, complicated, needing renewal, are less commonplace than they were for the farm kids of our 18th century republic."

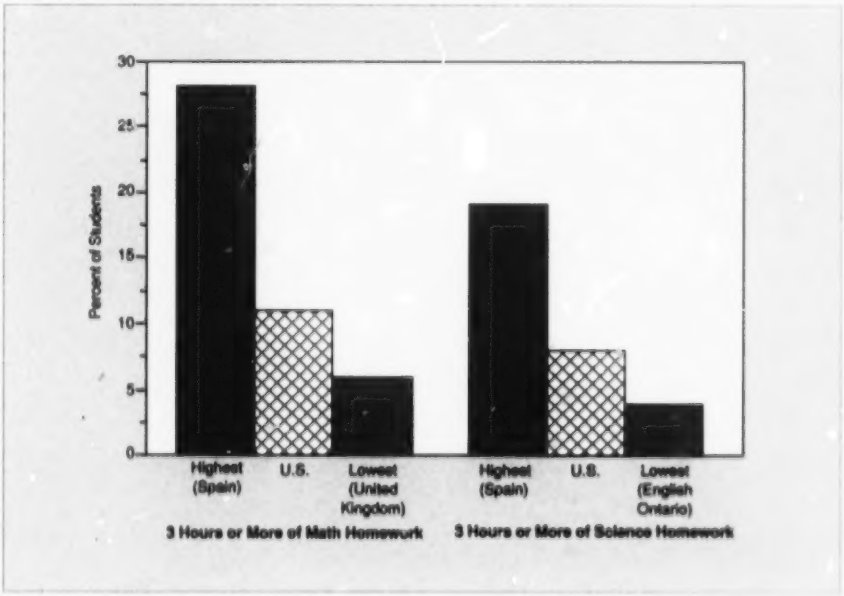
Reaching this higher plane requires overcoming a prevalent American belief that our mathematics and science teaching and learning are satisfactory; despite our poor performance in international assessments, studies show that American parents and students think we are doing pretty well. ETS's international assessment asked the 13-year-old students whether they think they are good at mathematics. The highest percent who thought they were good — 68 percent — were students in the United States, the nation scoring at the bottom in mathematics proficiency. In the highest scoring nation, Korea, only 23 percent said they were good at mathematics (see Figure 5). Students gauge themselves by the standards they perceive; the standards and the perceptions of U.S. students need to change.

The United States was second from the bottom in the percent of students who thought that what you learn in science classes is useful in everyday life (only half thought so, compared to eight of 10 in Korea). While 68 percent of American students said they like science a lot, that percentage was second lowest among groups assessed. (French Ontario, also having low performance, was highest with 84 percent.)

Measures of Commitment

While there are many ways to measure the American commitment to mathematics and science, an important one is to see how much homework American students do in these subjects. In the United States, just 11 percent of 13-year-old students do as

Figure 6
Percent of Students in Selected Countries Reporting Doing 3 Hours or More of Math and Science Homework per Week



many as three or more hours of homework in mathematics each week (see Figure 6). The highest percentage was in Spain, 28 percent, and the lowest in the United Kingdom, six percent.

In science, eight percent of U.S. students reported doing three or more hours of homework each week, compared with 19 percent in Spain and four percent in English Ontario. While there is no perfect correlation between homework and performance, raising performance in the U.S. will likely require more out-of-school student effort than is presently expended.

One additional comparison is striking: the amount of time students spend watching television. In the U.S., 31 percent of students reported watching five or more hours of television *each day*, the highest of any population assessed. In Korea, just seven percent reported watching that much television.

A World of Differences by Archie E. Lapointe, Nancy A. Mead, and Gary W. Phillips is available from the Center for the Assessment of Educational Progress at Educational Testing Service, P.O. Box 6710, Princeton, NJ 08541-6710. Detail on data used for comparisons of performance at different cognitive levels is available upon request.

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